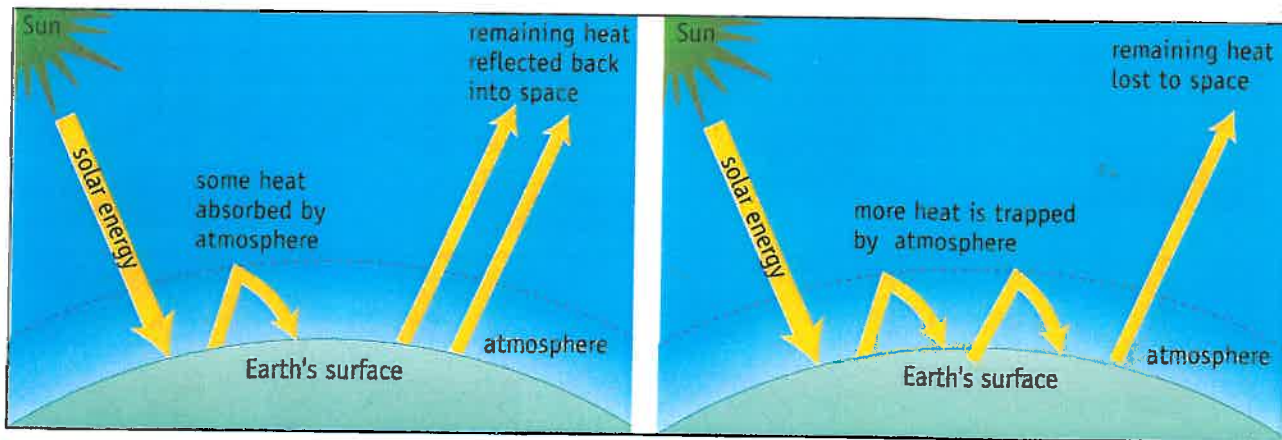


Global futures: the Greenhouse Effect

What is the Greenhouse Effect?

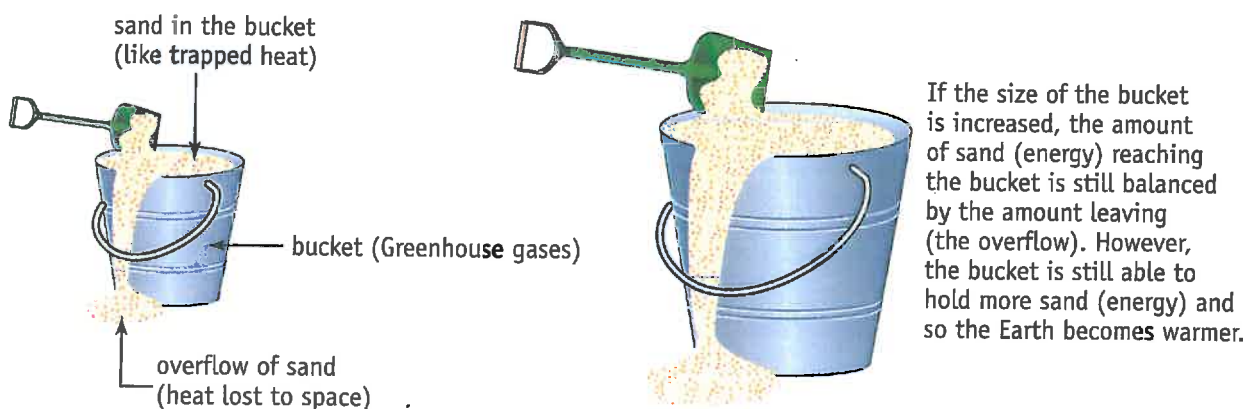
The **Greenhouse Effect** is the name given by scientists to the warming of the Earth due to the atmosphere of the planet being altered. Using that name can cause confusion because what actually occurs is not exactly like the events inside a greenhouse. In reality, the Sun's rays which come through the atmosphere are absorbed by the Earth's surface. All objects on the surface, including the soil, heat up and begin **radiating** or giving out heat themselves.

Figure 8.7 How the Earth's surface radiates heat itself



Much of this energy is absorbed by certain gases in the atmosphere, such as carbon dioxide, which we call the **Greenhouse gases**. This process makes it possible for us to survive on the planet because all life on Earth depends on this solar energy in some way. Figure 8.7 explains how the process works.

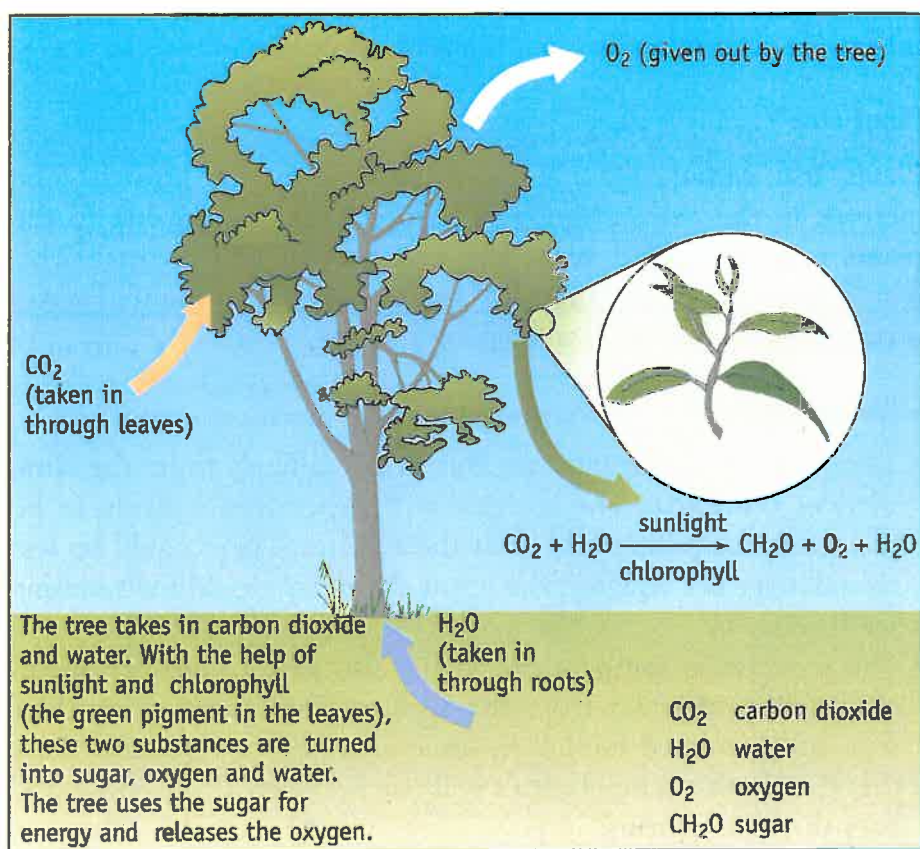
Figure 8.8 The 'bucket' of the Greenhouse Effect



The energy received from the Sun is like filling a bucket with sand (Figure 8.8). The sand in the bucket can be considered to be the trapped heat of the Earth; any sand which overflows out of the bucket is like the heat which is lost to space. The increase in concentration in greenhouse gases is like increasing the size of the bucket. Energy which strikes the Earth is still balanced by the energy leaving the Earth, but the bucket is bigger and so it can hold more energy, which means the Earth becomes warmer.

Trees, especially in forests, act in a similar way to lungs in human beings. They take in carbon dioxide through their leaves and use it to produce the energy they need to survive. The name of this process is **photosynthesis** and it occurs only in green plants. The green in their leaves is a substance called **chlorophyll**. The carbon dioxide is taken into the tree and through the process of photosynthesis is chemically changed, eventually producing oxygen which is released back into the atmosphere (Figure 8.9).

The atmosphere has always contained a certain amount of gases. They are very important because they absorb heat and help to keep the average surface temperature of the Earth at 15°C . Without them, the Earth would be much cooler than it is.



Modern industrialised societies burn a great deal of fossil fuels to make energy. This burning of fossil fuels releases more carbon dioxide into the atmosphere which trees need to process. Continued deforestation means that the trees are becoming less able to cope with these increasing levels of carbon dioxide in the atmosphere.

Figure 8.9 How the process of photosynthesis works

What does the future hold?

It is believed that this increase in concentration of the Greenhouse gases will lead to a rise in the Earth's mean temperature of about 3°C over the next 100 years. Although this does not sound like much, there could be other more dramatic changes as a result. However, some scientists believe that the Greenhouse Effect is not all bad. There are other changes which could *improve* the Earth's environment in some way.

Consequences of the Greenhouse Effect

Rising sea-levels

It is believed that the sea-levels may rise by between 28 and 66 cm because the glaciers and ice sheets will melt due to the increase in temperature. This may not sound very significant, but one-third of the world's population lives within 60 km of the coast! Such a rise in sea-level would mean large numbers of people would need to migrate further inland to find higher land.

Plant size

Plants use carbon dioxide to obtain energy for growth. The increase in the concentration of carbon dioxide available to the plants may mean that plant size and growth will increase. This would decrease the soil's fertility and increase the amount of water used by plants, leaving less for people to use.

Climatic changes

- Temperatures might increase, but this is unlikely to be the same all over the Earth. The increase in temperature is likely to be greater at the poles and less at the equator. There could be less rainfall over the equator; the ice at the poles would melt, raising sea-levels.
- The increase in temperature might also lead to an increase in evaporation of water from the surface. This might mean drier soils and increased rainfall in some areas. Some scientists think that the Earth's temperatures will rise between 1.5°C and 4.5°C over the next century.

If the sea-level rose, what would happen to countries like Fiji, Tonga and the Solomon Islands?

Increased rainfall

The increase in Greenhouse gases could change the world's climate. Areas that are now desert may receive more rainfall and be able to be used to grow food.

Increase in productivity

An increase in carbon dioxide in the atmosphere can encourage photosynthesis which would increase plant growth. Farms could produce more.

EXERCISE 3

OPTION A

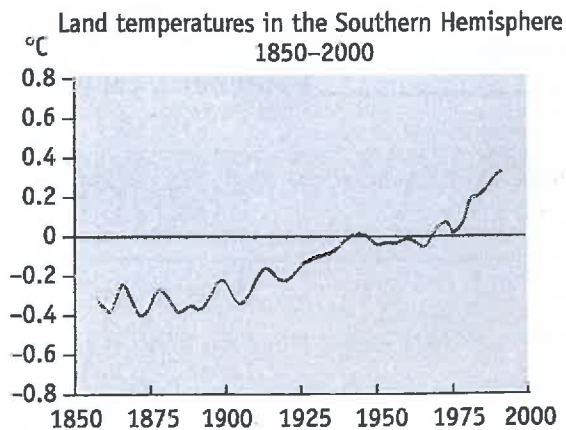
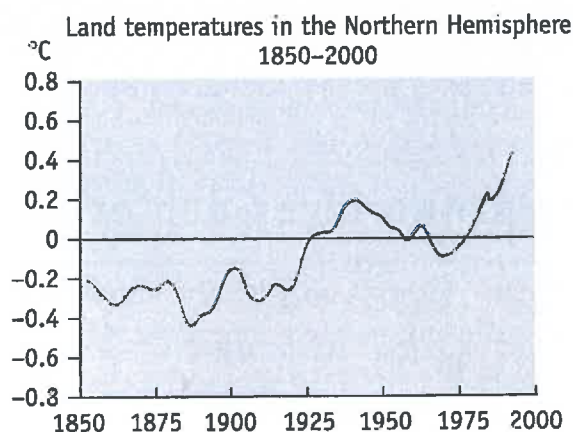
- 1 Research the possible consequences of the Greenhouse Effect in more depth. Add this to the previous information in this chapter.
- 2 Classify all these consequences using the table structure shown at right.
- 3 What conclusions can you draw from your classification table? What implications do they have for:
 - a the future of the global environment?
 - b the pattern of energy use around the world?
 - c the lifestyles of people in different parts of the world?

Table 8.3 Classification of consequences of the Greenhouse Effect

Positive effects		Negative effects	
People	Environment	People	Environment

OPTION B

Figure 8.10 How the surface temperature of the Earth has changed over time



EXERCISE 3 (cont.)

- 1 Some scientists also believe that the Earth's climate has changed over the centuries and that minor variations in average temperatures are always occurring—is this the case now? What does Figure 8.10 tell you has been happening with the surface temperature of the Earth over the last hundred years?
- 2 What implications does your interpretation of Figure 8.10 have for:
 - a the future of the global environment?
 - b the pattern of energy use around the world?
 - c the lifestyles of people in different parts of the world?

What can we do?

There are a number of steps that the ordinary person can take to help reduce the Greenhouse Effect in our everyday lives. We cannot change everything by ourselves, but one way in which people can help generally is by reducing the increase in the need for electricity. This then reduces demand for fossil fuels like the coal used to make electricity. Some changes that can be made include:

- 1 Reduce energy usage by using more efficient machines.
- 2 Turn lights and heaters off when you leave the room.
- 3 Walk when you can, not drive.
- 4 Do not leave windows or doors open when using a heater.
- 5 Close curtains to keep the heat in or put on an extra layer of clothing when cold.
- 6 Use insulation in houses and plant trees to shade the house in summer.
- 7 Use solar heating where possible.
- 8 Recycle products so that energy is not wasted in making new materials to make new goods.
- 9 Buy local products because they use less fuel in transport.

Try to find out more ways of reducing the consequences of the Greenhouse Effect.

Global futures: ozone layer depletion

Another outcome of humans' interaction with the atmosphere is the damage which we are causing to the ozone layer. The ozone layer is a protective shield in the Earth's atmosphere. It encircles the Earth and protects it from the harmful ultraviolet radiation effects of the Sun. Ozone is easily destroyed when it reacts with

harmful pollutants produced by chlorofluorocarbons which are used in refrigeration, air-conditioners, insulation production, electronics industry, and as propellants in aerosol sprays.

When ozone reacts with these chemicals, it is destroyed, and therefore a hole forms in this protective layer. This destruction occurs more readily in cold areas, particularly over the Antarctic continent where there has been a 40% reduction. The thinning is more marked during September to January.

EXERCISE 4

OPTION A

Draw a concept map to show the causes and effects of the Greenhouse Effect. Some examples are shown here.

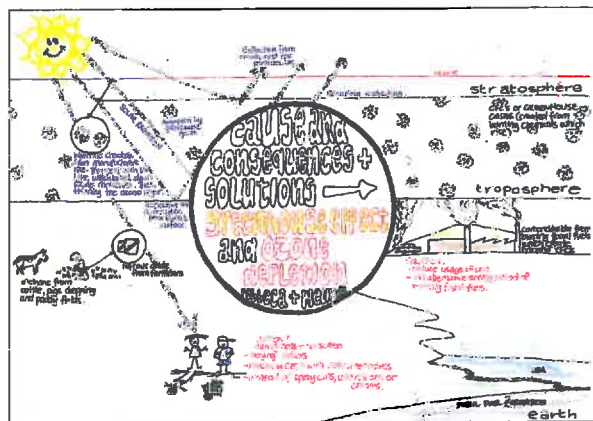


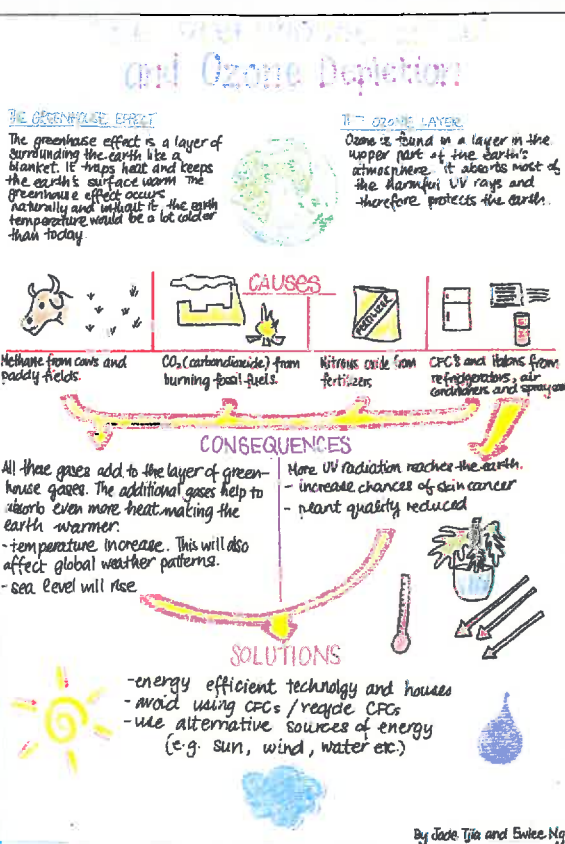
Figure 8.11 Examples of concept diagrams

OPTION B

- 1 Create a cartoon strip to explain what the Greenhouse Effect is and what might occur because of it.
- 2 Produce a 3-D model showing what you believe

OPTION C

- 1 Research the effects of ozone depletion on the following phenomena:
 - a Occurrence of cancers



the future will hold with respect to the Greenhouse Effect.

- b Disease occurrence in humans (for example, cataracts)
- c Agricultural production